Forest Sciences

Prince Rupert Forest Region

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The Size and Age Structure of Mature, Mixed-Species Forest Stands in the ICH Zone

Forests are the dominant vegetation complex in most areas of British Columbia, covering over 85% of the total land base. The B.C. Ministry of Forests currently recognizes 14 biogeoclimatic zones within the province, each representing areas of distinctly different climate, dominant vegetation type and general ecological conditions. Although predominantly single-species stands can be found in all forested areas, most of the natural stands in B.C. can be classed as mixed-species.

In terms of tree species diversity, the Interior Cedar-Hemlock (ICH) zone is one of the more complex biogeoclimatic zones in the province. The zone is divided into two portions, northwest and southeast, that together occupy almost 50,000 km^2. Mixed-species forests are typical throughout the entire zone and, in the northwestern portion, young to mature forests can contain up to nine tree species: western hemlock, western redcedar, lodgepole pine, hybrid spruce (*Picea glauca* x *sitchensis*), subalpine fir, paper birch, trembling aspen, black cottonwood and willow.

Most of the industrial forestry operations in this zone have been concentrated in **over-mature** hemlock / cedar or hemlock / subalpine fir stands. This has resulted not only in the misplaced perception that the ICH is a poor timber producing zone, but also in an almost complete lack of knowledge about the growth, development patterns, stand structure and quality of **mature** stands.

This extension note, the first in a series on ICH forests, will begin with an examination of the size and age structure of mature forest stands. In the classification of successional stages produced for the ICH zone, 'Mature' forests are listed as being between 100 and 200 years old.

The area being studied in this research project is a mesic, 135-year old, fire origin stand containing an intimate mixture of six main tree species: western hemlock, western redcedar, subalpine fir, lodgepole pine, hybrid spruce and paper birch. It is located in the Hazelton variant of the moist cold subzone (mc2) of the ICH at Date Creek.

Forests have long been described by their age distribution and / or their diameter distribution. Stands developing after major disturbances have been described as *even-aged*, since the trees have been assumed to regenerate shortly after the

Forest Sciences, Prince Rupert Forest Region
Bag 5000, Smithers, BC V0J 2N0 847-7500 (FAX 847-7217)

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disturbance. *Even-aged* stands are those where all trees are of the same age or age class (where the difference between the oldest and youngest trees does not exceed 20% of the rotation length). *Uneven-aged* stands are those that have at least three age classes intermingled on the same area. In addition, these stands are often described by their diameter distribution, ideally taking on a reverse-J shape.

These terms, however, can often be misleading where there is a wide range of ages following a single disturbance. With the exception of the most catastrophic events, most fires leave some of the original stand intact, either in small patches or as scattered individuals. In these stands, the *majority* of trees will develop after the disturbance but they will also include some survivors or veteran trees.

Mixed-species stands commonly contain a wide range of diameter classes, both between and within species, and often show a reverse-J shaped distribution. Figure 1 shows that the study stand does indeed exhibit these characteristics. The assumption that tree diameter is a good indication of age has led to the acceptance that these types of forests are uneven-aged or all-aged.

Many silviculturists commonly make the mistake of associating size with age in mixed-species stands. The assumption that large differences in size (diameter or height), within a species denotes different ages does not always hold true in mixed-species stands. In these types of stands, there can be considerable variation in size for trees of the same age. In the case of the study stand, many examples were found where larger trees were actually younger than smaller ones of the same species (Fig. 2).

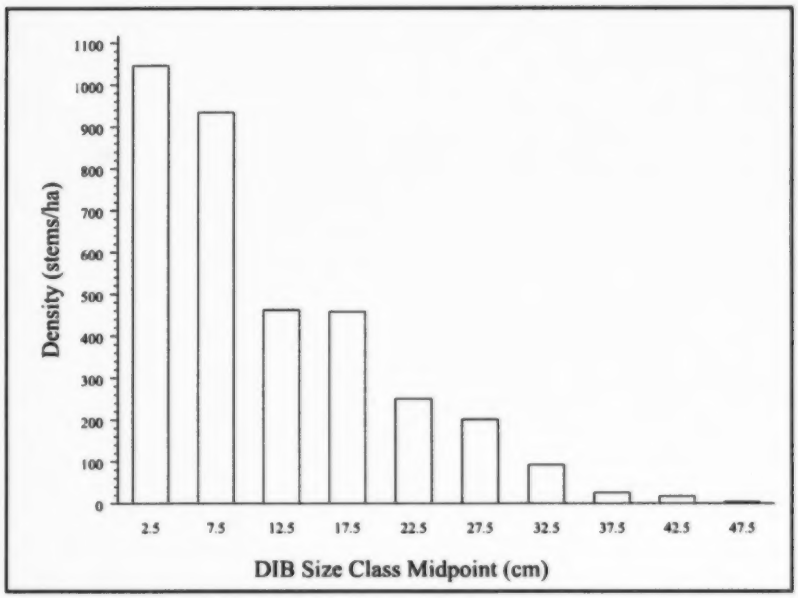

Figure 1. Diameter distribution by 5 cm diameter inside bark (DIB @ 1.3m) size class for all live stems.

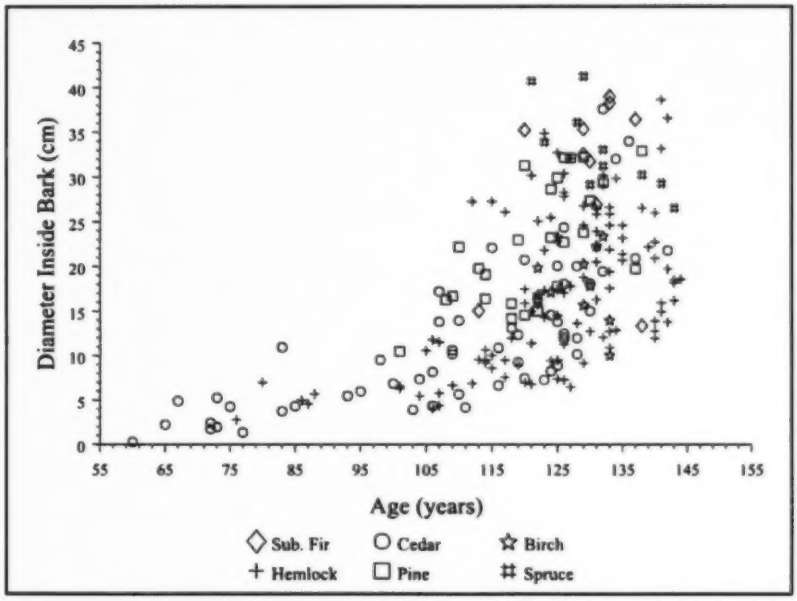

Figure 2. Scatter plot of diameter inside bark (@ 1.3m) versus age for all sample trees.

Since diameter distributions are still commonly used to determine the age structure of a forest, the mixed-species stand in this study would normally be classified as uneven-aged. When the trees in the stand are actually aged, however, we do not find a classic uneven-aged forest.

The majority of the trees in the stand being studied became established after a wild fire in 1855. Eighty-eight percent of trees sampled in this stand spanned an age range of over 90 years, indicating a long period of recruitment following the fire (Fig. 3). Eight percent of the trees sampled survived the 1855 fire, with the remaining 4% surviving both the 1855 and an earlier fire in 1834. The largest proportion (85%) of trees developing after the 1855 fire became established on the site within the first three decades (Fig. 3).

Virtually all of the lodgepole pine, hybrid spruce, subalpine fir and paper birch established during this period. While the majority of the western hemlock and western redcedar also became established soon after the fire, their recruitment continued for an extended period (Fig. 3)

Despite the wide range of ages found in this stand and the considerable variation in size, both between and within species, the continuity of the age distribution provides no evidence that any minor disturbances influenced the development pattern following the 1855 wild fire. This stand, therefore, does not meet the criteria of either an even or uneven-aged forest. It is much more appropriate to described these types of stands as *extended, single cohorts*.

It is apparent from this research that the mixed-species stands common to the ICH zone should not be classified solely on the basis of their size structure and that direct measures of age provide a much clearer description of the overall stand structure.

For more information, please contact:
Phil LePage, Research Silviculturist

Suggested reading

Larson, B.C. 1992. Pathways of development in mixed-species stands. p. 3-10. **In**: M.J. Kelty (ed.), The ecology and silviculture of mixed-species forests. Kluwer Academic Publishers. 287 p.

Oliver, C.D. and B.C. Larson. 1990. Forest Stand Dynamics. McGraw-Hill Inc. 467 pp.

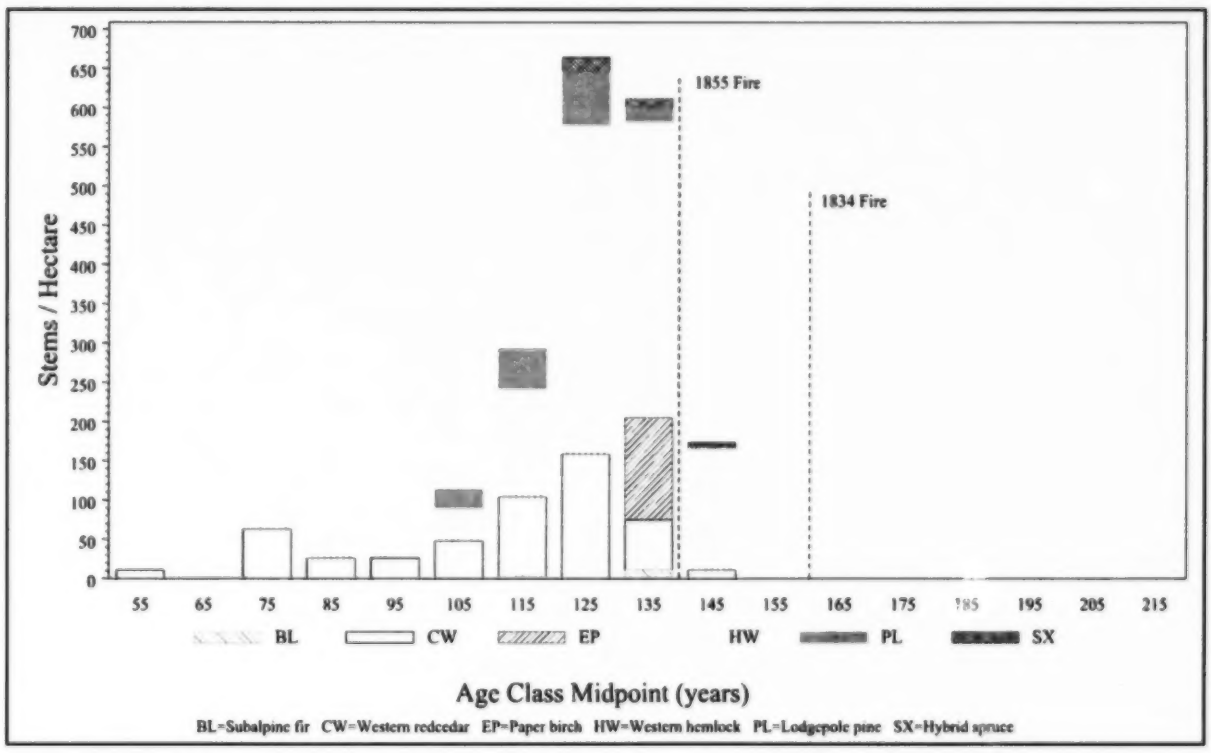

Figure 3. Age distribution of mature (135 years) stand, by species.